BIOLOGY TRANSFER ASSURANCE GUIDE (TAG)
January 29, 2021

Major Courses – Hours/Courses listed below that count toward the major or pre-major requirements	
OSC003 and OSC004 – Biology I & II	Credits: 8-10 Semester Hours
Advising Notes: All non-sequence coursework will be reviewed on a course by course basis by the receiving institution for transfer and application to the major.	
OSC024 – Full-Year Sequence of Biology I & II	Credits: 8-10 Semester Hours
Advising Notes: All non-sequence coursework will be reviewed on a course by course basis by the receiving institution for transfer and application to the major. Although the learning outcomes are grouped into two courses entitled Biology I and II, they do not necessarily have to be delivered in the arrangement suggested by the structure of this list (i.e., some institutions may choose to deliver the content of “Biology II” in the first course of their major course sequence).	
OSC028– Biology (Genetics)	Credits: 3-4 Semester Hours
Advising Notes:	

Institutional Requirements: For entrance and graduation, a transfer student must meet all institutional requirements which would include, but may not be limited to: minimum grade point average, residency requirements, upper division credits attained, minimum grades in specific courses, performance requirements (ex. dance, music) and other requirements of native students from the same institution

OSC003 – Biology I or OSC024 – Biology I and II Course Sequence (Revised 9/30/2016)
(A Combination of OSC003 and 004, 8-10 Semester Hours)

4-5 Semester Hours

Related TAGs: Biology, Bioengineering

General Course Description:
This course explores general biological problems and processes as they are experienced by all living organisms: the chemistry and energetics of life, molecular genetics, cell reproduction, and evolution. The course includes a required laboratory using actual biological materials; topics of the lab align to the course. Lecture to include a standard modern general biology text designed for a full-year sequence of introductory biology for science majors or the equivalent at the same level of rigor. Student Learning Outcomes (SLOs) are aligned with the core concepts and competencies which have been identified as foundations of undergraduate biological literacy by the National Science Foundation/American Association for the Advancement of Science.

Core Concepts include:

I. **Evolution**: The diversity of life is evolved over time by processes of mutation, selection, and genetic change.
II. **Structure and Function**: Basic units of structure define the function of all living things.
III. **Information Flow, Exchange and Storage**: The growth and behavior of organisms are activated through the expression of genetic information in context.
IV. **Pathways and Transformations of Energy and Matter**: Biological systems grow and change by processes based upon chemical transformation pathways and are governed by the laws of thermodynamics.
V. **Systems**: Living systems are interconnected and interacting.

Core Competencies are incorporated into:

VI. **Perspectives in Biology**; and
VII. **Practices in Biology**

In order for a course to be approved for OSC003 - Biology I, all of the following must be met:

1) Student Learning Outcomes (SLOs) marked with an asterisk (*) are required. Exception: If marked with a dagger (†), that SLO may be met in either Biology I or II or in both, but must be met in at least one of the two courses.
2) At least 70% of the total SLOs including the essential SLOs must be met, with a minimum of one SLO from each core concept and one from each competency in the context of an appropriate concept.
3) Core concepts II, III, IV, and V and core competencies VI and VII must be met. Concept I (Evolution) may be addressed only in Biology II (OSC 004) or in both Biology I (OSC003) and II (OSC004).
4) Note that certain SLOs fall under multiple core concepts as indicated by the Roman numerals in parentheses. These SLOs may be used to fulfill *both* core concepts or competencies.

CORE CONCEPTS:

I. EVOLUTION SLOs

1. **Describe the evidence for evolution.*†**
2. **Identify the evolutionary processes that lead to adaptation and biological diversity.*†**
3. Describe how the unity and diversity of life on earth emerge as a result of genetic inheritance through DNA and evolution by natural selection. (III)

II. STRUCTURE AND FUNCTION SLOs

1. Describe basic atomic structure and how atoms combine to form molecules.
2. Explain how the characteristics of life result from unique combinations that occur among a relatively small number of common atoms.
3. Describe the unique properties of the carbon atom, why it is important to life, and the basic ways in which organic molecules are constructed.
4. Describe the basic chemical and physical properties of water and how they facilitate processes essential for life.
5. **Describe the basic structural characteristics and biological importance of carbohydrates, lipids, proteins and nucleic acids.***
6. Apply chemical principles to the analysis of structure and function of biological macromolecules.
7. **Describe the structure and functional role of the cell and its constituent parts.***
8. **Recognize cells as the basic unit of life in all living organisms; compare and contrast the differences between prokaryotic and eukaryotic cells.*†**
9. **Compare plant and animal cell structure and function, including their respective organelles and other components.*†**
10. Describe current models of cell membrane structure and function.

III. INFORMATION FLOW, EXCHANGE, AND STORAGE SLOs

1. **Discuss DNA and its role in heredity, as well as how information from DNA is expressed in cells, and ultimately, the organism.***
2. Compare mechanisms of regulation of gene expression. (V)
3. Describe the structure, function and reproduction of cells, including viruses and microorganisms.
4. **Describe the major steps in a typical eukaryote cell cycle, including the details of mitosis and cytokinesis.*** (V)
5. **Explain the stages of meiosis, their significance, and how meiosis relates to sexual life cycles.***
6. Explain how different types of mutations affect gene products and phenotype. (II)

IV. PATHWAYS AND TRANSFORMATIONS OF ENERGY AND MATTER SLOs

1. Explain how chemical processes impact the cellular processes of life. (II,III)
2. Describe the enzymatic basis of the mechanisms that living organisms use to harvest energy.

3. **Outline the overall organization of the chemical pathways involved in cellular respiration and fermentation and how these pathways accomplish the processing of energy.*** (V)
4. Describe the principles of energy transformations through membrane embedded electron transport chains. (V)
5. **Summarize the overall organization of the chemical pathways involved in photosynthesis and how these pathways accomplish the conversion of light energy into chemical bond energy.*** (V)

V. SYSTEMS SLOs

1. Describe the basic principles of development. (III)
2. **Outline representative mechanisms that cells have evolved for communicating and coordinating their functions in a living organism.***
3. Explain how cell regulatory mechanisms ensure balance in living systems that interact continuously with their environments.
4. Apply knowledge of cellular regulatory mechanisms to explanations of aberrant cell behavior.
5. Describe the process of energy transfer from its source (the sun) through biological systems. (IV)

<u>CORE COMPETENCIES</u>:

VI. PERSPECTIVES IN BIOLOGY SLOs (Demonstrated within the relevant concepts)

1. Describe representative historical developments and perspectives in biology, including contributions of significant figures and underrepresented groups and the evolution of theories in biology.
2. Apply knowledge learned from the classroom with real life situations.

VII. PRACTICES IN BIOLOGY SLOs (Demonstrated within the relevant concepts)

1. Illustrate the scientific method through analysis of major biological discoveries.
2. Characterize the scientific method and its limitations in the search for answers to biological questions.
3. **Document the solution to scientific problems through collection and analysis of experimental data and the preparation of scientific reports.***
4. **Collect, organize, analyze, interpret, and present quantitative and qualitative data and incorporate them into the broader context of biological knowledge.***
    a. **Demonstrate the ability to make precise measurements.**
    b. **Demonstrate basic microscopy skills.†**
    c. **Prepare and make use of a serial dilution.**
    d. **Demonstrate safe and proper use of experimental techniques and tools/instruments.**
5. **Utilize current research literature, online information, and information related to scientific and biological issues in the mass media in written or oral reports.* (VI)**
6. Explain the applications and uses of recombinant DNA technologies and genomics, and their impact on society. (VI)

OSC004 – Biology II or OSC024 – Biology I and II Course Sequence (Revised 9/30/2016)
(A Combination of OSC003 and 004, 8-10 Semester Hours)

4-5 Semester Hours

Related TAG: Biology

General Course Description:
This course explores general biological problems and processes as they are experienced by all living organisms: plant and animal diversity, evolution, basic plant and animal systems, hormones, immunology, and ecology. The course includes a required laboratory using actual biological materials; topics of the lab align to the course. Lecture to include a standard modern general biology text designed for a full-year sequence of introductory biology for science majors or the equivalent at the same level of rigor. Student Learning Outcomes (SLOs) are aligned with the core concepts and competencies which have been identified as foundations of undergraduate biological literacy by the National Science Foundation/American Association for the Advancement of Science.

Core Concepts include:

I. **Evolution**: The diversity of life is evolved over time by processes of mutation, selection, and genetic change.
II. **Structure and Function**: Basic units of structure define the function of all living things.
III. **Information Flow, Exchange and Storage**: The growth and behavior of organisms are activated through the expression of genetic information in context.
IV. **Pathways and Transformations of Energy and Matter**: Biological systems grow and change by processes based upon chemical transformation pathways and are governed by the laws of thermodynamics.
V. **Systems**: Living systems are interconnected and interacting.

Core Competencies are incorporated into:

VI. **Perspectives in Biology**; and
VII. **Practices in Biology**

In order for a course to be approved for OSC004 - Biology II, all of the following must be met:

1) Student Learning Outcomes (SLOs) marked with an asterisk (*) are required. Exception: If marked with a dagger (†), that SLO may be met in either Biology I or II or in both, but must be met in at least one of the two courses.
2) At least 70% of the total SLOs including the essential SLOs must be met, with a minimum of one SLO from each core concept and one from each competency in the context of an appropriate concept.
3) All five core concepts and core competencies VI and VII must be met. Concept I (Evolution) may be addressed only in Biology II (OSC004) or in both Biology I (OSC003) and II (OSC004).
4) Note that certain SLOs fall under multiple core concepts as indicated by the Roman numerals in parentheses. These SLOs may be used to fulfill *both* core concepts or competencies.

CORE CONCEPTS:

I. EVOLUTION SLOs

1. **Describe the evidence for evolution.*†**
2. **Identify the evolutionary processes that lead to adaptation and biological diversity.*†**
3. Describe the evidence that endosymbiotic events resulted in the evolution of eukaryotic cells from prokaryotic ancestors.
4. Correlate the processes and results of scientific inquiry with the remodeling of animal phylogenetic relationships.
5. Explain how genomic comparisons allow phylogenetic relationships to be determined.

II. STRUCTURE AND FUNCTION SLOs

1. Relate levels of biological organization from cells, the basic unit of life, to the organism and the relationship of structure to function at all levels of biological organization.
2. Explain the basic structures and fundamental processes of life at the molecular, cellular, and organismal levels.
3. **Recognize cells as the basic unit of life in all living organisms; compare and contrast the differences between prokaryotic and eukaryotic cells.*†**
4. **Compare plant and animal cell structure and function, including their respective organelles and other components*†**
5. **Describe the general organization of the animal body and vascular plants.***
6. Describe and contrast reproduction and development in plant and animal systems.
7. Compare the structure of nutrient procurement and processing systems in plants and animals.
8. **Describe the structure and function of the nervous system, the musculo-skeletal system, the respiratory system, and the mechanisms of internal transport and regulation in various organisms.***
9. Explain differences in structure and function among the major invertebrate and vertebrate clades in terms of nutrition, life history, and evolutionary relationships.

III. INFORMATION FLOW, EXCHANGE, AND STORAGE SLOs

1. **Outline the fundamentals of the endocrine system at the systemic level.* (II)**
2. Describe basic processes of infectious disease and defense against infection.

IV. PATHWAYS AND TRANSFORMATIONS OF ENERGY AND MATTER SLOs

1. **Explain how energy moves through an ecosystem.***

V. SYSTEMS SLOs

1. **Explain how regulatory mechanisms at the level of the whole organism ensure balance in living systems that interact continuously with their environments; compare regulatory mechanisms within and across species.* (III)**
2. Describe the relationship between life forms and their environment and ecosystems.
3. **Describe the different types of relationships that exist between living organisms.***
4. Explain how populations grow and how this can be described mathematically.
5. Describe the basic principles of conservation biology.
6. **Describe and explain various types of animal behavior.***
7. Describe advantages and disadvantages of social behavior.

CORE COMPETENCIES:

VI. PERSPECTIVES IN BIOLOGY SLOs (Demonstrated within the relevant concepts)

1. Describe representative historical developments and perspectives in biology, including contributions of significant figures and underrepresented groups, and the evolution of theories in biology.
2. Compare costs and benefits of preserving endangered species and protecting the environment.
3. Apply knowledge learned from the classroom with real life situations.

VII. PRACTICES IN BIOLOGY SLOs (Demonstrated within the relevant concepts)

1. Illustrate the scientific method through analysis of major biological discoveries.
2. Characterize the scientific method and its limitations in the search for answers to biological questions.
3. Document the solution to scientific problems through collection and analysis of experimental data and the preparation of scientific reports.
4. **Collect, organize, analyze, interpret, and present quantitative and qualitative data and incorporate them into the broader context of biological knowledge.***
    a. **Demonstrate the ability to make precise measurements.**
    b. **Demonstrate basic microscopy skills.†**
    c. **Demonstrate safe and proper use of experimental techniques and tools/instruments.**
    d. **Use biological specimens to explain the relationship between structure and function**.
5. **Utilize current research literature, online information, and information related to scientific and biological issues in the mass media in written and oral reports.* (VI)**

OSC028- Biology (Genetics) (Updated January 29, 2021)

Credit Hours: 3-4 Semester Hours

Pre-Requisite: OSC003 (Biology I) or Equivalent

General Course Description:
This course explores general genetics problems and processes as they are experienced by all biological systems: the nature of genetic materials, transmission/patterns of inheritance, molecular biology of gene function, gene expression and regulation, genetic variation, evolution and population genetics, comparative genetics/methods and tools and genetics and bioethics. With the evolving nature of the field it is critical for a bioethics component to be embedded in this course. Lectures include a standard modern general biology genetics text designed for introductory biology genetics for science majors to provide a strong basis for learning. Student Learning Outcomes (SLOs) are aligned with the core concepts and competencies which have been identified as foundational for undergraduate biological genetics literacy by the Genetics Society of America. Core Concepts include:

I. Nature of Genetic Materials
II. Transmission/Patterns of Inheritance
III. Molecular Biology of Gene Function
IV. Gene Expression and Regulation
V. Genetic Variation
VI. Evolution Genetics
VII. Comparative Genetics/Methods and Tools
VIII. Genetics and Bioethics

In order for a course to be approved for OSC028 - Biology (Genetics), all of the following must be met:

1) Student Learning Outcomes (SLOs) marked with an asterisk (*) are required.
2) A minimum of 70% of the Student Learning Outcomes, including essential outcomes marked with an asterisk (*), must be met.

CORE CONCEPTS:

I. NATURE OF GENETIC MATERIALS

What are the nature, structure and function of genetic components found in different biological systems.

1. Compare the molecular nature and structure of genetic materials found in prokaryotic and eukaryotic cells as well as bacterial, animal and plant viruses. *
2. Describe the molecular and cellular mechanisms involved in DNA replication. *
3. Explain genetic repair processes expressed in different biological systems.
4. Summarize the relationships between genome replication and different states of the cell cycle in prokaryotes and eukaryotes.

II. TRANSMISSION/PATTERNS OF INHERITANCE

What are the mechanisms by which an organism's genome is passed on to the next generation.

1. Describe the mechanism by which prokaryote and eukaryote genomes are transmitted to the next generation. *
2. Recall the stages of meiosis and indicate what is happening during each stage. *
3. Describe organelle genetics. *

How can one deduce information about genes, alleles, and gen functions from analysis of genetics crosses and patterns of inheritance.

1. Follow alleles over several generations using Punnett squares and Mendelian terminology. *
2. Analyze pedigrees to determine patterns of inheritance, including sex linkage. *
3. Analyze data from a population to determine the influence of alleles versus the environment on phenotypes.

How does the phenomenon of linkage affect the assortment of alleles during meiosis.

1. Describe genetic linkage and the role homologous recombination plays in allele transmission. *
2. Explain the relationship between chromosomes and sex determination. *

III. MOLECULAR BIOLOGY OF GENE FUNCTION

How is genetic information expressed so it affects an organism's structure and function.

1. Explain how the genetic code relates transcription to translation. *
2. Discuss how various factors might influence the relationship between genotype and phenotype (e.g. incomplete penetrance, variable expressivity, and sex-limited phenotype). *
3. Explain how abnormalities in gene dosage can affect phenotype.
4. Describe how changes in the number of triplet repeats can alter gene function and phenotype.

IV. GENE EXPRESSION AND REGULATION

How can gene activity be altered in the absence of DNA changes.

1. Discuss the roles of types of RNA other than mRNA in expressing genetic information. *
2. Describe the similarities and differences in eukaryotic and prokaryotic gene expression. *
3. Contrast the packaging of DNA into euchromatin versus heterochromatin in the context of histone modification, and DNA modification. *
4. Discuss the potential roles of DNA modification, histone modification, and non-coding RNA in epigenetic inheritance, both in somatic and germline. *

How do genes and genomes control changes in an organism's structure and function throughout its life cycle.

1. Describe how differential histone modification modulates gene activity and is utilized in developmental progression. *
2. Explain how polarity is established in a developing embryo using gene expression gradients. *
3. Use a model system to describe investigations of evo-devo.

4. Describe genetic cascades; use the sex-determination cascade to explain how differential gene expression can result in the development of different sexes.

V. GENETIC VARIATION

Describe how different types of mutations may affect gene function and explain the potential impact of that mutations may have on the corresponding mRNAs and proteins produced by the cell.

1. Describe how mutations affect phenotype. *
2. Compare the conditions that result from different types of chromosome variations in humans.
3. Explain the role of chromosome variation in plants. *
4. Identify and describe the different types of transposable elements.
5. Explain the role of transposition on individual organisms and evolution.
6. Describe the impact of mutations to different classes of genes and their role in the development of cancer.
7. Describe the impact of epigenetic changes in cancer genetics.
8. Describe how genetic material can be transferred among microbial cells.

VI. EVOLUTION GENETICS

What are the processes that can affect the frequency of genotypes and phenotypes in a population over time.

1. Explain the difference between organismal and population genetics. *
2. Apply Hardy-Weinberg equilibrium to population genetics.
3. Describe the influence of population genetics on evolution.

VII. COMPARATIVE GENETICS/METHODS AND TOOLS

Making comparisons between organism toward greater understanding of human genetics.

1. Describe the genetic conditions currently being treated using genetic therapy.
2. Explain methods of genetic testing. *
3. Discuss the characteristics of the model organisms that make them useful for comparison to human genetics.

What experimental methods are commonly used to analyze gene structure, gene expression, gene function, and genetic variants.

1. Describe techniques used to obtain and analyze genomic and proteomic information. *
2. Explain the importance of model organisms to the understanding of human genetics.
3. Describe methods used for gene editing and gene therapy (e.g. CRISPR).
4. Explain the process and use of various experimental methods involving recombinant DNA technology methods.
5. Describe the use of recombinant DNA technology in biotechnology.

VIII. GENETICS AND BIOETHICS

1. Identify and critique scientific issues relating to biology ethics in genetics (e.g. genetic testing and gene editing). *

BIOLOGY TAG
FACULTY PARTICIPANTS
September 2015 – September 2016

Name	Institution
John Plenefisch (Lead)	The University of Toledo
Karen Sirum	Bowling Green State University
Wendy Gagliano	Clark State Community College
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Rachael Detraz	Edison State Community College
Caroline Breitenberger	The Ohio State University
Caryl Tickner	Stark State College

BIOLOGY TAG
FACULTY PARTICIPANTS

Name	Institution
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Robert Bast	Cleveland State University
Wendy Vermillion	Columbus State Community College
Steve Leidich	Cuyahoga Community College
Caroline Breitenberger	The Ohio State University
Scotty Moody	Ohio University
Lauren DiCaprio	Ohio University
Robert Connor	Owens Community College
Bob Deal	Shawnee State University
Phyllis Williams	Sinclair Community College
Terry Flum	Southern State Community College
William Bishoff	The University of Toledo

BIOLOGY (GENETICS) TAG
FACULTY WRITING PANEL PARTICIPANTS
January 29, 2021

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Anne Bullerjahn	Owens Community College
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